Task-Oriented Coaching for Teaching Instructional Planning: A Design-Based Research Approach

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Abstract: This paper is concerned with the gradual development and validation of an instructional model for teaching instructional planning to prospective teachers in secondary level business schools. The model is based on the assumptions that a) instructional planning can be considered as a design task, and b) learning to cope with these tasks is effectively supported by task-tailored coaching interventions. Since the goal of the investigation is to engineer and study coaching as an innovative form of assisting learning within the prevailing educational context, model development and validation activities were funded on a design-based research approach. These activities include 1.) a review of currently available scientific literature in design research and education, and 2.) a series of four formative research studies. The aims of the paper are to outline the general idea of the task-oriented coaching model and to reflect the activities that were carried out for model development and validation.

Introduction

Creating a learning world inevitably involves instructional planning: Instructional planning is one of the most central tasks in all teaching professions, mainly because it is the process by which teachers link curriculum to learning. Hence, it may be viewed as a cornerstone of effective teaching. Given the importance of instructional planning, educational practitioners as well as researchers agree that novice teachers should concern themselves with learning this process. However, although this learning requirement is widely accepted, a substantial lack of research exists with respect to the questions of what planning abilities novice teachers actually need and how these abilities could be developed. As Greta Morine (1979: 135) bluntly puts it, the paradox of planning abilities is "that it is an area of the teacher education curriculum, for which almost no planning has been done." The investigation that I will present in this paper tries to contribute to fill this gap by gradually developing and validating an instructional model for teaching planning abilities to prospective teachers in secondary level business schools. The model is based on the following assumptions:

a.) In accordance with researchers in teacher cognition and teaching expertise (e.g., Clark & Yinger, 1987), I suppose that instructional planning may be seen as a *design task*. Like other design professionals (e.g., architects and engineers), teachers are required to construct a functional product, in this case an effective learning environment. This assumption implies that prospective teachers need to develop design abilities.

b.) Along with Schön (1987) and other scholars in design research and education (e.g., Dinham, 1989), I further assume that any designlike practice must be learned by doing and that this kind of experiential learning is most effectively supported by task-tailored *coaching* interventions.

Since the goal of the investigation is to engineer and systematically study coaching as an innovative form of assisting learning within the prevailing educational context, I decided to fund the model development and validation activities on a design-based research approach. These activities included two steps:

1.) In order to provide a theoretical baseline for the task-oriented coaching model, I first reviewed currently available scientific literature in design research (1) and education. This literature was analyzed in view of three questions:
   - i What are the central demands of design tasks?
   - ii What knowledge and skills are needed to effectively cope with these demands?
   - iii What instructional means might be effective in fostering the development of this knowledge and these skills?

2.) In order to validate and further refine the task-oriented coaching model, I secondly conducted a series of four formative research studies. These studies focused on the question whether the task-oriented coaching model is an effective way for fostering prospective teachers' planning abilities.

Given the current status of the research, one aim of this paper is to outline the general idea of the task-oriented coaching model. Furthermore, a second intention is to reflect the activities that were carried out for model development and validation. To this end, I begin with an overview of the theoretical background of the coaching model. In the next sections, I will then describe the methods used for putting the design-based research approach into practice and delineate what I have learned so far by briefly portraying the major 'products' of this

research. Finally, I will discuss the model development and validation activities in terms of 'further research needs' and 'open questions'.

Theoretical background of the task-oriented coaching model

With respect to the above mentioned questions, the review of the design research literature revealed the following insights:

Demands of design tasks

In its most general sense, design can be characterized as "a disciplined inquiry engaged in for the purpose of creating some new thing of practical utility." (Rowland, 1993: 80). This 'new thing' or artifact may be material or immaterial in nature (e.g., a dwelling house, a machine component, an advertising spot, a business strategy). Since the artifact is required to have practical utility, or as design researchers usually say should be "functional", it must be both, effective in the sense that it obtains a set of intended goals and, at the same time, realizable with high degrees of confidence (e.g., cookware must be heat-resistant *and* not weigh too much for the average cook; an automobile must be sensitive to future customer needs such as security and velocity *and* fit into dimensional constraints of existing highways and garages). Besides this general characterization of design, most design researchers (e.g., Lawson, 1997) agree that design problems are ill-structured, complex and unique, i.e. they

- are uncertain and underdetermined in that they usually have only vaguely defined or unclear goals and constraints, only abstractly or schematically stated evaluation criteria and no predetermined solution path. Hence, they may have many alternative solutions.
- encompass many, sometimes conflicting needs and constraints as well as many solution variables to be considered simultaneously. Thus, design solutions may never be perfect, but almost invariably involve compromise.
- elude complete routinization.

Knowledge and skills needed to effectively cope with design tasks

Given the above mentioned characteristics of design tasks, design researchers (e.g., Lawson, 1997; Rowland, 1993; Schön, 1987) assume that they pose the following knowledge and skill requirements:

- Due to the double-barreled nature of design tasks, they presumably involve both technical skills as well as creativity, rational and intuitive thought processes. For example technical skills are needed to analyze the situational constraints and to identify requirements, while creativity is important for coming up with ideas to figure out a structure of the artifact that incorporates these requirements and constraints.
- In order to ensure effectiveness and feasibility of the artifact, designers furthermore need to be able to integrate knowledge from multiple content domains (e.g., inventing a strategy for tackling the problem of environmental pollution requires components from mathematics, science, political science and psychology, designing an office accommodation involves knowledge from ergonomics as well as aesthetics).
- Because of the ill-structured, complex and unique nature of design problems, they require the problem solver to engage in extensive phases of problem understanding, problem structuring and problem framing, often using graphical representation systems. They also require greater commitment and self-awareness from the problem solver.
- Furthermore, sophisticated skills in argumentation and justification are needed in order to help the designer to rationalize and evaluate his design decisions.

As recent empirical studies from different design domains (e.g., Goel & Pirolli, 1989; Jeffries et al., 1981) suggest, designers are aided in the design process by experience-based design schemas that partition the problem into a set of meaningful tasks. These schemas include components that assure that tasks will be carried out properly, processes that control the generation of designs, and evaluation procedures that ensure effective utilization of knowledge. As with most complex tasks, these problem schemas are used to monitor and regulate performance.

Instructional means to foster development of design knowledge and skills

As the seminal research workings of Donald A. Schön (1987) suggest, design tasks are not only hard to cope with but also pose severe challenges for teaching and learning. That happens to be mainly because they entail a considerable communication gap, which might not be adequately bridged by verbal or graphical descriptions alone but additionally requires the medium of action. More specifically, Schön (1987) provides the following reasons:

- Although it is possible to describe general rules, procedures or criteria to be used in skillful designing, the most important rules cannot be followed in a simple mechanical way. Since they are more like heuristics than algorithms, they must always be individualized and translated to the present case or design context. For example, a general rule like "find a viable problem structure" or a design criterion like "effectiveness" or "appeal" gain their meaning only when they are applied to a specific product to be designed. The processes involved in applying a general rule or criterion to fit the design context at hand are not easily amendable to descriptions, but might be better conveyed by actual designing.
- Even when design instructors do succeed in making descriptions of designing that they perceive as relatively full, accurate and useful, beginning students are likely to find them confusing, vague, ambiguous or incomplete. Thus, the meanings they initially construct from these descriptions might be incongruent with their instructors' intentions. The clarification of intended meanings and the discovery and resolution of incongruities between instructors' intentions and students' understandings again might be best achieved through action.
- Last but not least, substantial difficulties for design educators result not only from unclear description or understanding, but from the creativity inherent in designing. Since design means to create a new thing or artifact, it cannot be described in advance; otherwise it would not be new. Likewise, the required learning processes must be mediated by action.

For any or all of these reasons, Schön concludes that

> "[d]esigning must be learned by doing. However much students may learn about designing from lectures and readings, there is a substantial component of design competence – indeed the heart of it – that they cannot learn this way. A designlike practice is learnable but is not teachable by classroom methods. And when students are helped to learn to design, the interventions most useful to them are more like coaching than teaching." (Schön, 1987: 157)

Coaching in this sense has much in common with current constructivist learning approaches such as "Cognitive Apprenticeship" (Collins, Brown & Newman, 1989), "Problem-based learning" (Schwartz, 2002) or "Anchored Instruction" (Bransford, 2001). It is a highly interactive and flexible process that emphasizes the mutual flow of information between coach and student. More specifically, it involves that they gradually make transitions of meaning by joining in a particular communicative enterprise - a dialogue which is centered on authentic design tasks. In this dialogue, coach and student "convey messages to each other not only, or not even primarily, in words but also in the medium of performance." (Schön, 1987: 163). When it works well, this dialogue takes the form of a reciprocal and reflective learning circle.

However, as Schön (1987) as well as other researchers in design and professional education (e.g., Akin, 2002; Kirschner et al., 1997; Rowland, Fixl & Yung, 1992) point out, teaching design within a coaching approach is not simply a matter of trial-and-error but a demanding design endeavor in it self. In particular, it involves creating a learning setting which at least should address the following issues:

1. *Providing structure and basic knowledge support*: As already figured out, designing is hardly ever learned without being practiced within the context of a particular design task. However, in order to enable students to initiate in the process of learning by doing and to join in the task-oriented dialogue, some prerequisite knowledge at a higher level of generalization (e.g., central definitions of the field or essential chains of reasoning) might be needed. Thus, the coach must provide structures to integrate this knowledge within the process of task-oriented learning and teaching. Furthermore, he must carefully analyze what basic knowledge this might be and decide how the acquisition of this knowledge can be effectively supported.
2. *Identifying and arranging authentic design tasks*: Furthermore, design educators need to identify real or at least realistic design tasks and cases suitable for demonstration and training. These tasks should incorporate substantive issues of designing, be representative for the design domain at hand and be realizable within the scope of an institutionalized learning context. Besides this, they preferably must be drawn up and arranged in such a way that students are challenged but not overwhelmed and that the burden of task performance gradually shifts to them over time.
3. *Modeling of experts' design strategies*: Given that the ultimate aim of the coaching approach is to initiate learners into the actual strategies used to solve authentic design problems, design educators are required to explicitly model these strategies so that their students can observe, enact and practice them. Since these strategies involve thinking processes that usually are tacit or covert, they have to find adequate means for externalization and demonstration.
4. *Tailoring guidance and feedback*: As elaborated above, students' initial attempts of design learning are very likely to produce confusion and misunderstandings. In order to avoid or at least minimize

detrimental effects of this learning predicament (e.g., sense of loss or thoughtless activism) and to direct students learning by doing into the right channels, design educators need to be able to constantly monitor and evaluate students' understandings and progress. Given the results of this assessment, they furthermore have to particularize their subsequent guidance and feedback to the problems that emerged.

In sum, these insights from design research offer both a first impression of what generic skills competent design actually involves as well as a tentative set of guidelines or general framework to develop instruction for supporting their learning. However, they raise the question of how this general framework might be filled out within the scope of learning how to plan instruction in the context of secondary level business education. In order to more fully explore this question and thus sustain model development and refinement, a series of formative research studies was carried out. These research studies will be addressed in more detail in the following two sections.

Methods of the design-based research

Research design

In accordance with the tenets of design-based research (e.g., Barab & Squire, 2004; Collins, Joseph, & Bielaczyc, 2004; DBRC, 2003; Edelson, 2002), the exploration and further development of the coaching model entailed the creation and gradual refinement of an instructional intervention that instantiates the above mentioned general framework within the prevailing context of educating teachers in secondary level business schools. This instantiation was realized by designing, implementing and evaluating a master's level university course over four iterations. The course, which is part of a university teacher education program at the University of Mannheim (Germany), was delivered as a collaborative endeavor of two instructors, Professor Hermann G. Ebner, and me. The four course deliveries took place from winter semester 2002/03 to summer semester 2004. Consistent with a case study approach, each course delivery is regarded as "a phenomenon … occurring in a bounded context" (Miles & Huberman, 1994: 25), and hence is defined as the unit of analysis. As depicted in figure 1, the evaluation results of one course delivery (i.e. concept instantiation) were used to inform design decisions of the next course. Moreover, data from the four deliveries were submitted to a comparative cross-case analysis.

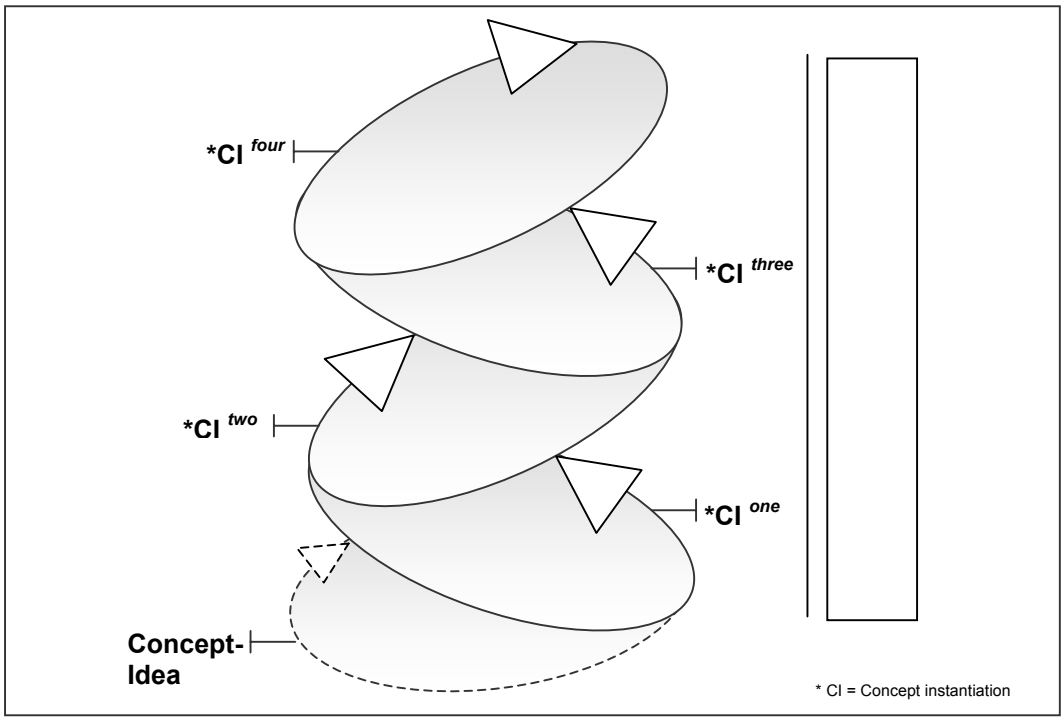

Figure 1. Research design

Participants

Participants of the four case studies include 64 students (50 percent female) enrolled at the above mentioned university teacher education program. All students had already mastered their basic economics and business administration courses and had done some first work experience in this field (e.g., as trainees). Their

experiences as a teacher ranged from no experience at all to modest teaching experience (e.g., as private tutors). The allocation of the participants to the cases was as follows: C1: n = 23, C2: n = 5, C3: n = 20, and C4: n = 16.

Course description

The syllabus of the master's level university course encompasses 14 class meetings each semester with one and a half contact hours per week and additional homework. Due to the specific objectives of the coaching model, the course is focused a) on basic planning knowledge (e.g., competence-oriented curricula, cognitive models of learning), and b) on the planning process and its different stages. To make this process salient to the participants, we created a specific procedure for planning instruction in secondary level business schools. This procedure is intended to capture the above mentioned demands of design tasks and to put them into context with contemporary cognitive and activity theoretical conceptualizations of learning and instruction (e.g., Jonassen & Land). Furthermore, the procedure reflects current reforms in national curriculum frameworks, which provide that instruction in the domain of secondary level business education should be centered on representative work assignments of prospective employees in this field. The procedure involves three interrelated planning phases: 1. task analysis, 2. goal setting, and 3. instructional framework construction and elaboration.

In order to flesh out the task-oriented coaching model, each of the four course deliveries incorporated decisions on the above mentioned instructional elements, i.e. (1) course structure and basic knowledge supports; (2) authentic planning tasks; (3) modeling of planning expertise, and (4) guidance and feedback on students' responses to the planning tasks. For the purpose of reassuring traceability and comprehensibility of the design-based research (e.g., DBRC, 2003), pre-course planning decisions as well as planning decisions during the semester were entered into detailed working protocols. Furthermore, e-mail contact between the instructors was collected. All of the data was summarized and condensed into chronological course log files. A summary of the design decisions in the four cases is depicted in table 1 (for a detailed description cp. Aprea, 2007).

Table 1: Summary of the design decisions in the four cases.

	Case 1 (Winter 02/03) (n = 23)	**Case 2 (Summer 2003) (n = 5)***	**Case 3 (Winter 03/04) (n = 20)**	**Case 4 (Summer 2004) (n = 16)**
Course structure & basic knowledge support	- Dual structure - texts, "mini-lectures" & reflective activities on planning-related facts & concepts	Integrated course structure was developed	Same as Case 2	Same as Cases 2 & 3
Authentic planning tasks	- Supplier selection - Personnel recruitment - Contractual arrangement & sales order	Heuristic tool for developing learning goals was added	Same as Case 2	Heuristic tool for inventing instructional strategies was added
Modelling	- Structured overview - Concept mapping tool for task analysis	Worked-out example was added	Process-related texts were added	Same as Case 3
Feedback & guidance	Individual feedback-conferences (30 min per person)	Individual feedback-conferences (1 h per person)	Collective feedback and additional phase-related exercises were added	Same as Case 3

* Due to the relatively small group size, which resulted from a change in study regulations, case two was excluded from quantitative statistical analyses as elucidated in the following paragraph.

Evaluation dimensions, instruments and procedures

To provide a sound basis for decision-making and to ensure trustworthiness and credibility of the research results, proponents of design-based research (e.g., Collins, Joseph, & Bielaczyc, 2004; Reigeluth & Frick, 1999; van den Akker, 1999) advocate the principle of triangulation, i.e. to consider multiple aspects of the intervention, to include diverse perspectives and to combine various research methods. With this in mind, each course delivery was evaluated with respect to two dimensions. The first dimension, *learning output effects*,

addressed the question to what extent participants of the course achieved the intended learning goals, i.e. acquired basic planning knowledge and were able to create adequate instructional plans. The second dimension, *learning process effects,* aimed to find out whether the course and its elements assisted students and instructors to initiate and sustain those processes that are necessary to achieve these goals. Moreover, each dimension was further differentiated as follows.

Learning output effects

This dimension was subdivided into a) objective (i.e. test-based) learning output effects, and b) subjective (i.e. student-rated) learning output effects.

a.) To measure *objective learning output effects*, two assessment tasks were used:
   i. For the purpose of measuring students learning outputs in terms of basic knowledge acquisition, they were asked to complete a *Concept Mapping Task.* This task was administered at the end of the course and dealt with the topic of "Effective Learning and Teaching in Business Schools". The student-generated maps were analyzed with respect to how elaborated the central concepts of the course (e.g., goals of competence-oriented curricula, components of instructional strategies) were depicted and how well they were organized. Single concepts were scored by using an assessment rubric with four performance levels (4 = proficient; 3 = satisfactory; 2 = limited; 1 = deficient). Moreover, a total sum score (unweighted arithmetic mean) was calculated for each map.
   ii. In order to determine how well students are able to create instructional plans, they were asked to individually practice upon an *Authentic Planning Task* in the form of a take-home final. Since this planning task encompassed that the students gradually stride through the above mentioned planning phases, their responses to this planning tasks, i.e. their evolving instructional plans, are assessed with respect to the completeness, accuracy and sophistication of how each phase was performed. As with the Concept Mapping Task, a four performance level assessment rubric (4 = proficient; 3 = satisfactory; 2 = limited; 1 = deficient) was used to determine single scores for each phase. Single scores were then added up to phase-related total sum scores (unweighted arithmetic means).

   For each course delivery, single and total sum scores of all learning output measures were submitted to a descriptive analysis. Furthermore, the concept map sum score as well as the sum scores for each planning phase were compared in the cross-case analysis by using the Student's t-test.

b.) To determine *subjective learning output*, a final evaluation questionnaire was applied. With respect to this sub-dimension, the questionnaire included three rating questions. These questions asked students to indicate on a four-level scale (4 = fully agree; 1 = do not agree) whether they think that (i.) their theoretical planning knowledge, and (ii.) their practical planning skills might have increased. Furthermore, they were requested to estimate (iii) whether they will be able to prospectively apply what they have learned. As with the objective learning output measures, students' ratings of these questions were first submitted to a descriptive analysis for each case and then compared via t-tests in the cross-case analysis.

Learning process effects

This dimension was elicited from two perspectives, namely a) from the perspective of the instructors, and b) from the perspective of the students.

a.) To estimate *learning process effects from the instructors' perspective*, we continuously kept record of our own experiences and observations of (individual and collective) student-instructor-interactions during the course, made notes from our weekly instructor meetings and gathered informal feedback from students by asking simple questions such as "How did this work?" or "How could you have learned more effectively from this?". All of the data was entered into working logs and categorized and assessed with respect to perceived strengths and weaknesses of the course and its instructional elements.

b.) To assess *learning process effects from the students' perspective*, the final evaluation questionnaire was used again. Depending on the particular arrangement in the different course deliveries, the questionnaire contained four to six rating questions. Each question addressed a specific instructional element of the course (e.g., modeling of the planning process, feedback and guidance) and asked students to indicate on the already mentioned four-level scale how helpful the respective element was for their learning process. Students' answers to the rating questions were processed in the same way as the objective and subjective learning output measures. Besides the rating questions, the questionnaire contains two open-ended questions which asked students what they liked and disliked in the course. Any students' comments on this form were transcribed and, again, analyzed with respect to perceived strengths and weaknesses of the course and its instructional elements.

Products of the design-based research

Thus far, the design-based research yielded three kinds of 'products': 1.) A functional prototype of the task-oriented coaching model, 2.) a set of common challenges in learning how to plan instruction, and 3.) a number of suggestions for prospective improvements of the model. These products will be described in more detail in the next paragraphs.

Functional prototype of the task-oriented coaching model

The evaluation of the last iteration, case four, yielded the following objective learning outputs:
With respect to the *Concept Mapping Task*, 61 percent of the participants in this case (n = 16) demonstrated a performance that was satisfactory or better (M = 2,44; SD = 0,58, with '4' indicating a proficient or excellent performance). The same applies to 78 percent of the participants with respect to the task analysis phase of the *Authentic Planning Task* (M = 3,02; SD = 0,65) as well as to 71 percent with respect to the goal setting phase of planning (M = 2,90; SD = 0,70). Moreover, 64 percent of the participants were able to adequately tackle the phase of instructional framework construction and elaboration (M = 2,78; SD = 0,71).

Besides this, cross-case analysis comparisons demonstrated that subjects from case four outperformed subjects from the other cases in terms of all objective output measures, with statistically significant differences between the cases one and four for the three Planning Task performance scores (2).

Albeit with a somewhat different nuance, the results concerning objective learning output effects are by and large mirrored by the subjective learning output measures. In this respect, all participants in case four (n = 16) consented that they have expanded their theoretical planning knowledge (M = 3,67; SD = 0,49, with '4' indicating full agreement). Moreover, 80 percent stated that their practical planning skills might have increased (M = 3,20; SD = 0,94). However, with regard to these estimates only the mean differences between the cases one and three proofed to be statistically significant in favor of the last-named.

Last but not least, the indicators of objective and subjective learning output effects seem to be in compliance with the data concerning learning process effects. In this respect, for example, nearly all participants of the case studies (n = 64) expressed their esteem for the individual feedback conferences, uttering that they were very helpful (58 percent) or at least helpful (38 percent) for their learning (overall M for this course component = 3,49, SD = 0,70, with '4' indicating full agreement). Concerning the element 'authentic planning tasks' (i.e. working out of students' own instructional plans), the same applies for 54 and 41 percent of the sample, respectively (overall M = 3,48; SD = 0,65). Likewise, the data support the assumption that the elaborated modeling element as from case two was beneficial in sustaining development of students' planning abilities (overall M = 3,16; SD = 0,73).

To sum up, even though lack of statistical significance for the subjective learning output measures in case four urges to be cautious, these results, on the whole, encourage me to suggest that the design-based research activities so far have lead to a functional prototype of the task-oriented coaching model.

Common challenges in learning how to plan instruction

According to our observations during classes and/or individual feedback conferences as well as to the analyses of students' responses to the assessment tasks, there seem to be the following common challenges in prospective secondary level business school teachers' learning how to plan instruction:

- Some students had a rather naïve way of approaching the planning task. They initially found it unfamiliar to systematically plan by figuring out task demands, learning goals and frameworks of instruction. Quite often, they struggled with linking the different phases of planning and/or got stuck in one phase.
- Moreover, students occasionally had difficulties in providing appropriate reasons for their design decisions and/or to clearly articulate what they are going to do.
- In addition, students sometimes got in trouble with the ambiguity of the design task at hand, and with the fact that learning to cope with this task inevitably involves errors and mistakes.

As empirical findings in design research and education (e.g., Goel & Pirolli, 1989; Rowland, 1993) suggest, this (non-exhaustive) list of challenges in learning how to plan instruction mirrors ubiquitous learning predicaments of novices in other design professions.

Suggestions for model improvements

As a third 'product' of the design-based research, the results of the formative studies particularly suggest improvements of the task-oriented coaching model with regard to two aspects:

- One aspect which students frequently complained about in their answers to the open-ended question of the evaluation questionnaire concerns the expenditure of time that learning in the planning course deserves. As a possible solution to tackle this problem, they proposed to 'gain learning time' by prospectively linking contents of the course with other courses in the teacher education curriculum.
- The other improvement aspect pertains to students' doubts regarding the question whether they think that they will be able to apply what they have learned. As the results of the cross-case comparisons

demonstrated, mean values for this subjective learning output measure constantly remained on a relatively low level of about 2,70 (SD between 0,35 and 0,58, with '4' indicating full agreement). Obviously, none of the mean differences between the four cases proofed to be statistically significant. One possible interpretation of this evaluation result might be that students feel insecure about their abilities, and that we, consequently, have to offer them further possibilities to practice the to be learned knowledge and skills.

Discussion

Given the previously described products of the design-based research, I feel that the research activities, all in all, essentially promoted the concern of studying what learning to plan actually involves and how this learning could be supported effectively. However, they unavoidably remained incomplete in the sense that they point out a range of issues that need to be addressed by further research. In particular, these issues comprise:

- The expansion and exploration of the task-oriented coaching model with other instructors, universities and institutions in teacher education, respectively.
- The inclusion of 'online-measuring' of students' learning processes (e.g. via think aloud protocols).
- The supplementation of the design-based research with experimental studies (e.g. regarding the fine tuning of the instructional elements 'authentic planning tasks', 'personal feedback and guidance' and 'modelling of the design process').

Besides this need for further research, the research activities raised two questions for me, which are related with the methodology of design-based research:

1. Perhaps as other users of this methodology, I firstly asked myself what might be sound and feasible guidelines to help researchers deciding upon which parts of the usually fairly huge sets of collected data should be included in the process of constructing viable claims.
2. In doing this kind of research, I secondly wondered how to determine the end of a design-based research project or, in other words, how to formulate reasonable 'stopping rules' for design and development iterations.

I would be very grateful to discuss these and similar questions within the community of scholars in the learning sciences and in design-based research.

Endnotes

(1) To avoid misunderstandings, I would like to point out that the term 'design research' is used to denote conceptual and empirical works in the design professions whereas 'design-based research' is used to label a specific methodological approach to educational research.

(2) $\alpha = .05$ for 'task analysis' and 'instructional framework' sum scores; $\alpha = .01$ for 'goal setting' sum score.

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